

METHOD AND SYSTEM FOR SENSITIVE DETECTION
OF MOLECULAR SPECIES IN A VACUUM
BY HARMONIC DETECTION SPECTROSCOPY

ABSTRACT

Provided is a novel method and system for harmonic detection spectroscopy. The method comprises providing a cell having a sample region which is circumscribed by at least one wall. The cell has at least one light entry/exit port, with each entry/exit port containing a light transmissive window having a surface facing the sample region and disposed so as to seal the cell in the circumferential direction. A sample gas flows through the sample region in a direction parallel to a cell central axis, and the cell operates at less than atmospheric pressure. A frequency and/or amplitude modulated light source is provided for directing a light beam through one of the at least one light transmissive windows into the cell. The light source modulation amplitude is set to a value which approximately maximizes the value of a harmonic signal at the center of the absorption feature due to the detected gas phase molecular species inside the sample region, and the center frequency of the light source is adjusted so that it is either locked to the center of the absorption feature or repetitively scanned over the frequency range which includes the feature. A spectra is then generated which may be recorded individually or averaged. A detector is provided for measuring the light beam exiting the cell through one of the at least one light transmissive windows. The light source and detector are contained within a chamber which is external to the cell and isolated from the sample region, the chamber and the sample region being placed in optical communication with each other through at least one of the at least one light transmissive windows. The pressure inside the chamber is controlled to a value which is positive relative to atmospheric pressure. The method can be used to detect gas phase molecular species in a sample. Particular applicability is found in semiconductor processing.

FIGURES 2a and 2b